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(54) A mounting structure.

(57) A mounting structure for an element (1) which is to be given a fixed setting. The mounting structure is intended to be mounted on a building, building part, base structure etc. The characteristic feature of the mounting structure is an axle (5) which is mounted both rotatable in and essentially vertically at a holder (4) which in turn is mounted on the building or equivalent structure, an azimuth angle rough-adjustment member being thereby formed. An azimuth angle fine-adjustment member (18) includes a slab (10) which is rotatably mounted on a transverse beam (6) fixed on the axle (5) and which rotates around a pivot pin disposed between the beam and the slab. The element (1) is mounted rotatable on the slab by means of two pivot pins (16) the longitudinal axes of which coincide with and intersect the longitudinal axis of the pivot pin. An elevation angle adjustment member (29) of variable length which extends, in a way well-known in itself, between a fixed point of the element (1) and a point of the axle (5) is articulately fixed at each one of these points. The joint with the element permits turning of the element in the azimuth and elevation directions, whereby when operating the azimuth angle fine-adjustment member (18) the element (1) turns around an imaginary axis (AZt) which passes through the pivot pin and the joint (31) f the elevation angle adjustment member with the element (1).

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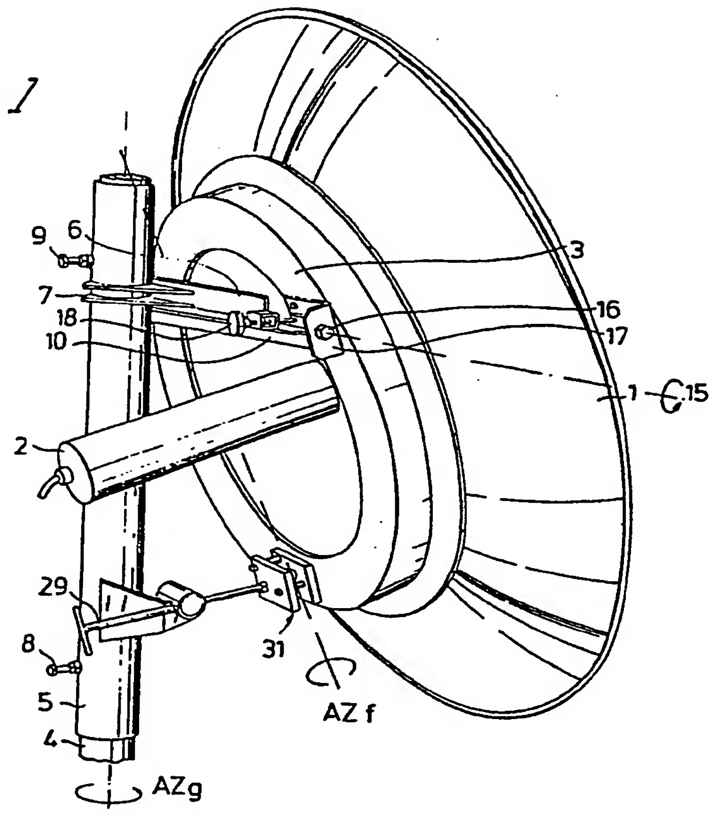
Fig.1



A MOUNTING STRUCTURE

This invention refers to a mounting structure for an element which is to be directed to a fixed point in space. The element may be a mirror or a spot-light which is to be directed to a fixed point in space. However, the element preferably is a parabolic antenna of the kind which is intended to be used in receiving TV signals from stationary satellites. The mounting structure is intended to be mounted on a building, for example a house, a building part, for example a house gable, a chimney, a house wall, a house roof, a mast or a base structure, for example a pillar of concrete, iron etc. anchored in the ground (similar to those used for supporting a sundial).

Mounting structures for parabolic antennae which are intended to be used for receiving television pictures from geostationary satellites are well-known. A prior mounting structure of this kind includes a stand with a rotatable aerial mounted in the stand which antenna is to be directed to the satellite apparently stationary in the sky.

The stand is placed on a bed and after making a rough adjustment a series of small adjustments of the azimuth and elevation angles are carried out, said adjustments influencing each other, so that a satisfactory setting may be achieved.

Another prior mounting structure for parabolic antennae includes a mast tube bent at an angle on which the aerial is fixedly mounted. The mast tube is mounted vertically, and the aerial is turmed so that it points towards the satellite in the azimuth direction. The portion bent at an angle now has such a predetermined inclination in relation to the vertical line that the antenna is presupposed to point approximately in the correct elevation direction. Means is provided for set-

ing the elevation direction.

The first one of the above-mentioned prior mounting structures is suited for mounting on house roofs only. The mounting structure cannot be mounted on a vertical wall, a chimney or on an existing mast tube. The second one of the above-mentioned mounting structures is mounted in the same way as conventional mast tubes and may thus be mounted, for example, on a house gable. A drawback of this mounting structure is, however, that the elevation angle is determined by the mast tube bent at an angle and that tubes having different elevation angles accordingly in principle, must be manufactured for places lying at different latitudes.

The present invention aims at providing a mounting structure of the kind described by way of introduction, which avoids the limitations of the prior mounting structures, is easy to install at buildings and building parts, such as gables, chimneys, mast tubes, fundaments etc. and which is adjustable in the azimuth and elevation directions, the lastmentioned adjustments taking place highly independently of each other. The characteristic features of the invention will be seen from the attached claims.

By the fact that the adjustments in the azimuth and elevation directions can be made almost quite independently of each other it is possible to perform a precise setting of the element. After the element has been roughly set it is possible to realize the setting of the element towards the fixed point with only one azimuth angle fine-adjustment and one elevation angle adjustment. The order in which the two lastmantioned settings take place is important. If one starts with the azimuth angle fine-adjustment and thereupon carries out the elevation angle adjustment, no more adjustments need to be effected but the element now points right towards the fixed point. On the other hand, if one

begins with the elevation angle adjustment and then carries out the azimuth angle fine-adjustment, an additional after-adjustment of the elevation angle must normally occur before the element points right towards the fixed point.

During the azimuth angle fine-adjustment and during the elevation angle adjustment the adjustment members by means of which the adjustments are performed are self-maintaining, i.e. the set position is not altered, for example owint to a blast or owing to the installer leaving hold of the aerial or the aerial mounting structure with both hands and instead, for example, calibrating a signal strength instrument by means of which the aerial setting is performed. The entire installation and adjustment process will thereby be rapid, simple and precise.

The invention will be described more closely below in connection with the attached drawings, in which

FIG. 1, in a perspective view, shows a mounting structure according to the invention,

FIG. 2 to 4, in lateral views, show various mountings of the mounting structure according to the invention,

FIG. 5, in a plan view from above, at an enlarged scale and in different proportions compared to FIG. 1, shows a beam included in the mounting structure,

FIG. 6, in a plan view from above and at the same scale as FIG. 5, shows a slab turnable around the beam of FIG. 5,

FIG. 7 is a lateral view along the line VII-VII in FIG. 3,

FIG. 8, in a perspective view, shows a detail of the azimuth angle fine-adjustment as seen obliquely from below,

FIG. 9, in a perspective view, shows the same detail as FIG. 8 but as seen obliquely from above and with a pivot pin mounted thereon,

FIG. 10, in a perspective view, shows the elevation angle adjustment member,

FIG. 11, in a plan sectional view, shows a detail of the elevation angle adjustment member of FIG. 10,

FIG. 12 is a diagram showing the path along which an imaginary central ray from the centre of the element moves in space at the adjustment towards the fixed point, if the azimuth angle fine-adjustment is accompanied by the elevation angle adjustment, and

FIG. 13 is a diagram showing the path along which an imaginary central ray from the centre of the element moves in space at the adjustment towards the fixed point, if one begins with adjusting the elevation angle.

FIG. 1 shows an element in the form of a parabolic aerial or antenna 1 having a microwave head 2. The antenna is connected to the mounting structure by means of an annular holder 3. In the embodiment illustrated of the invention the mounting structure is mounted on a substantially vertical mast tube 4. The mounting structure includes an axle which in this embodiment of the invention is a sleeve 5 which is threaded on to the mast tube 4. A shoulder, not shown, for example a piece of tube, may be anchored to the mast 4 to support the sleeve on the mast tube until the sleeve has been locked to the mast tube 4 by means of locking members as described below.

FIG. 2 shows how a mounting structure which is mounted on a mast tube according to the invention is mounted on the roof of a house. At A the mast tube 4 is fixedly mounted

on a stand which is screwed on the roof. At B the mast tube passes through the roof and is anchored to a roof truss. At C the mast tube 4 passes through the roof and is anchored to a roof beam. In the B and C cases the mast tube is sealed in a conventional way to the roof covering by means of a roof collar (not shown). In FIG. 2 the axle is in the form of a sleeve which is threaded on to the mast tube in accordance with FIG. 1. In FIG. 3 the mounting structure is shown fixed to a chimney by means of straps which are fastened around the chimney. Each strap is provided with a conventional holder. The axle of the mounting structure is here fixed to the holder by means of conventional U-bolts D. By loosening these U-bolts D the azimuth direction of the mounting structure may be roughly adjusted, whereupon the U-bolts are tightened. In this embodiment the axle need not necessarily be a sleeve but may be, for example, a solid rod. In FIG. 4 is shown how the mounting structure may be fixed to a wall by means of conventional brackets and U-bolts. By loosening the U-bolts rough setting in the azimuth direction may be performed.

FIG. 1 shows the remaining main parts of the mounting structure according to the invention. A beam 6 is fixedly attached to, for example welded to, a holder 7 which in turn is fixedly attached to, for example welded to, the sleeve 5. The longitudinal axis of the beam is substantially at right angles to the longitudinal axis of the sleeve. As will be seen from FIG. 5, the sleeve 5 is located unsymmetrically along the beam to make room for the microwave head 2 (cf. FIG. 1). In case the antenna is without a microwave head the sleeve is preferably located symmetrically, i.e. at the centre of the beam 6. By turning the sleeve 5 around the mast tube 4 the antenna is rough-adjusted in the azimuth direction. Thus, the rough-adjustment takes place over a range of 0 to 360°. The sleeve is locked at the rough-adjusted azimuth angle (which is counted in relation to a

fixed direction, for example North) by means of two locking screws 8 and 9 placed at the top and at the foot, respectively, of the sleeve. Each locking screw is threaded into a nut which is welded to the peripheral surface of the sleeve and which passes through an opening, not shown, in the wall of the sleeve, said opening being positioned opposite the nut.

A slab 10, for example an L-beam, is articulately supported by the beam 6 at a pivot pin 11 (cf. FIG. 6) in the form of a bolt welded to the slab and extending upwards through an opposite opening 12 (FIG. 5) in the beam 6. The slab 10 thus depends from the beam 6 by means of a nut not shown and is rotatable in relation to the beam. At each end of the slab 10 a nut 13 and 14, respectively, (FIG. 6) is welded with the longitudinal axes of the nuts lying in the horizontal plane. The location of the nuts is such that imaginary line 15 coinciding with the longitudinal axes of the nuts cuts the longitudinal axis of the pivot pin 11, i.e. the centre of rotation of the azimuth angle fine-adjustment. Each nut is intended to receive a threaded pivot pin 16. The longitudinal axes of the pivot pins thus lie in the interface between the slab 10 and the beam 6. Two opposite angle brackets 17 (FIG. 1 and FIG. 9) are fixedly connected with, for example screwed into, the holder and are rotatably mounted on the pivot pins 16, whereby the parabolic aerial accordingly is rotatably connected with the mounting structure and can rotate around the axle 15 for adjusting the elevation angle and, as above mentioned, around the substantially vertical pivot pin 11 for fine-adjustment of the azimuth angle. The relative rotation between the slab and the beam is brought about with an azimuth angle fine-adjustment member 18 in the form of an adjustment screw 19 (cf. FIGS. 8 and 9) which extends between the slab and the beam and which is articulately connected with the slab 10 and with the beam 6 at pivot pins 20 and 21. The

pivot pin 21 is articulately mounted in an extended part 22 of the beam 6 and the adjustment screw is threaded into an opening, not shown, which extends radially transversely through the pivot pin 21. The front point of the adjustment screw 19 has no thread but is smooth and extends through a likewise radial through opening not shown in the pivot pin 20. The front point is rotatable in this opening but is anchored against axial movement in relation to the pivot pin 20 by a ball joint not shown or by lock washers, cotter pins or the like (not shown) positioned at both sides of said ball joint. The pivot pin 20 is rotatably mounted in a boring in a tongue 23 which projects from the nut 13. At the opposite end of the adjustment screw a flat adjustment knob 24 is provided. It is seen from the above that the azimuth angle fine-adjustment member is self-locking (irreversible).

In place of the illustrated member 19 to 24 for realizing relative movement between the beam 6 and the slab 10 a stretching screw articulately mounted at both ends may, for example, be used. Also a rotatable cam disk, for example an eccentric, may be used for realizing this movement, the beam and the slab in the lastmentioned case being prestressed against each other, for example by means of a helical spring.

The fine adjusted azimuth angle is locked by means of two bolt joints (FIGS. 5 and 6) provided at either side of the pivot pin 11. Each bolt joint passes through an opening 25 in the slab 10 and a sector-shaped opening 26 in the beam 6. The centre of the sectors passes through the pivot pin 11. From the figures 8 and 9 it is seen that each bolt joint includes a bolt 27 and a locking nut 28. During the azimuth fine-adjustment the nuts are loosened and after terminating the fine-adjustment they are tightened, the top surface of the slab 10 being locked against the bottom surface of the beam 6.

An elevation angle adjustment member 29 (FIGS. 1 and 10) extends between the aerial 1 and the sleeve 5 and is articulately connected with each of these units; the connection being realized with the sleeve by means of a pivot pin 30 and with the aerial by means of a ball joint 30. The adjustment member is made in the form of an adjustment screw 32 which is threaded through the pivot pin 30 which is rotatable in a bearing sleeve 33. This bearing sleeve 33 is rigidly connected, for example welded, to the sleeve 5. The pivot pin 30, shown in detail in FIG. 11, consists of a threaded pin having a thickened head 34. A boring 35 passes transversely through the thickened head 34, and in this boring the adjustment screw 32 is threaded. Opposite the boring 35 elongated through openings 36 are provided in the peripheral surface of the bearing sleeve 33 so that the adjustment screw is turnable to some extent around the longitudinal axis of the bearing sleeve. The pivot pin 30 may be locked against rotation in relation to the bearing sleeve 33 by means of a nut 37 which is threaded on to the end of the pivot pin 30.

The ball joint 31 (FIG. 10) includes a ball 38 which is fixedly connected, for example screwed, in the front tip of the adjustment screw 32. The ball 38 is fastened under pressure between two plates 39, 40, each provided with conical or spherical depressions in which the ball is received. The plate 40 which may be an integrated part of the parabolic aerial is fixed to the holder 3, for example, by screwing. The plate 40 may also be an integrated part of the holder 3. By means of a locking screw 41, which passes through the plate 39 with a clearance and which is threaded into the lower plate 40 only, the position of the ball 38 may be locked between the plates 39, 40. In adjusting the elevation angle the nut 37 is first loosened and then the ball joint is loosened by means of the locking screw 41. The adjustment screw 32 is thereupon rotated by

turning a handle 42 fixed at the end of the screw until a maximum of signal strength is obtained from the antenna. Thereupon the ball joint 31 is locked and finally the pivot pin is locked with the nut 37.

Only axial forces, i.e. forces directed in the axial direction of the adjustment screw, act on the ball joint. No lateral forces act on the ball joint, since all such forces are taken up by the transverse beam 6. The ball joint is necessary for taking up the movement around the axle AZ_f, described below, and the angle change of the adjustment screw.

Instead of the elevation angle member 29 shown above one may use a stretching screw which is articulately fixed to the aerial and the axle, respectively.

As an element of variable length corresponding to the adjustment screw 32 one may also use two rods, tubes etc. engaging each other and provided with through holes which are moved opposite each other, whereupon a locking member, for example a cotter, bolt-joints etc., is moved through the two holes opposite each other and fixes the set elevation direction.

From the above description it is clearly seen that the rough-adjustment of the azimuth angle takes place around an axle, designated by AZ_g in FIG 1, which coincides with the longitudinal axis of the sleeve 5, while the fine-adjustment of the azimuth angle takes place around another axle, designated by AZ_f in FIG. 1, which passes through the pivot pin 11 and the ball joint 31. Owing to the fact that the axle 15 around which the element is turned at the adjustment of the elevation angle passes through the pivot pin 11 and that the axle 15 lies in the interface between the beam 10 and the slab 6, an imaginary central ray which emanates from the antenna, in operating the elevation adjust-

ment member, will point towards a point in space which then moves along a vertical line. This means that the adjustments in the azimuth and elevation directions are highly independent of each other. This is clearly illustrated in connection with FIGS. 12 and 13 which show the path of an imaginary central ray from the aerial covers in space from a point X, which corresponds to the point at which one ends when the antenna has been rough-adjusted in the azimuth and elevation directions, to a point 0 which corresponds to the fixed point in space towards which the aerial is to be directed. The azimuth angle fine-adjustment member in its starting position has the beam 6 arranged parallel to the slab 10, i.e. the turning angle between these units is zero. When turning the slab 10 in relation to the beam 6, i.e. at the azimuth angle fine-adjustment, the imaginary central ray follows the parabolic path in space indicated by dashed lines.

According to FIG. 12 an azimuth angle fine-adjustment from the point X is first carried out until the antenna points straight under the fixed point 0 (which manifests itself by a maximum of signal strength measured on a field strength meter), the central ray following the path indicated by the arrow 43. Thereupon the elevation angle adjustment is carried out from the head of the arrow 43 up towards the fixed point 0, the central ray following the path indicated by the arrow 44 (when the maximum of signal strength is obtained, the point 0 has been found). If now the axle or sleeve 5 should not be absolutely vertically disposed but be inclined an angle α to the vertical, the central ray, at the lastmentioned setting, would move along the dashed line in FIG. 12, said dashed line likewise including the angle α with the vertical (indicated by a dot and dash line).

If when directing the aerial from the point X to the point 0, one begins instead with the elevation angle adjustment

from the point X up to the level of the point 0, the central ray describing the path indicated by the arrow 45, and then performs the azimuth angle fine-adjustment, the central ray following the path indicated by the arrow 46, and elevation angle error Δ arises which must be corrected by a renewed elevation angle adjustment, from the head of the arrow 46 to the point 0, the central ray following the path indicated by the arrow 47. In this case there will thus be required (apart from the rough-adjustment of the elevation and azimuth angles) three adjustments against only two if proceeding in the way illustrated in FIG. 12.

The embodiment of the invention as described above can be modified and varied in many ways within the scope of the basic idea of the invention.

CLAIMS:

1. A mounting structure for an element (1) which is to be given a fixed setting. The mounting structure is intended to be mounted on a building, building part, base structure etc. The characteristic feature of the mounting structure is an axle (5) which is mounted both rotatable in and essentially vertically at a holder (4) which in turn is mounted on the building or equivalent structure, an azimuth angle rough-adjustment member being thereby formed. An azimuth angle fine-adjustment member (18) includes a slab (10) which is mounted rotatable on a transverse beam (6) fixed on the axle (5) and which rotates around a pivot pin (11) disposed between the beam and the slab, as well as a member (19-24) for rotating the slab in relation to the beam around the pivot pin. The element (1) is mounted rotatable on the slab by means of two pivot pins (16) the longitudinal axes of which coincide with and intersect the longitudinal axis of the pivot pin (11). An elevation angle adjustment member (29) of variable length which extends, in a way well-known in itself, between a point of the element (1) and a point of the axle (5) is articulately fixed at each one of these points. The joint with the element permits turning of the element in the azimuth and elevation directions, whereby when operating the azimuth angle fine-adjustment member (6,10,11) the element (1) turns around an imaginary axis (AZ_f) which passes through the pivot pin (11) and the joint of the elevation angle adjustment member with the element.

2. A mounting structure according to claim 1, in which the longitudinal axes of the pivot pins lie in the interface between the slab (10) and the beam (6).

3. A mounting structure according to claim 1 or 2, in which the axle is a sleeve (5).

4. A mounting structure according to claim 1, in which

the member (19-24) of the azimuth angle fine-adjustment member (18) includes a member of variable length, for example a fine adjustment screw (19), which extends between the slab (10) and the beam (6) and which is articulately fixed both to the slab and to the beam.

5. A mounting structure according to claim 1, in which the elevation angle adjustment member includes an adjustment screw (32).

6. A mounting structure according to claim 1, in which a locking device for locking said mounting structure and the element fixed thereon in the fine-adjusted azimuth position includes two opposite bolt joints (27,28), each extending between the slab and the beam through a sector-shaped through opening (26), said sector having the pivot pin (11) as a centre.

7. A mounting structure according to claim 3, in which the adjustment screw (32) of the elevation angle adjustment member is articulately supported adjacent the sleeve by means of a pivot pin (30) or a ball joint.

8. A mounting structure according to claim 7, in which the adjustment screw (32), at the end thereof facing the element is rigidly connected with a ball joint (31) intended to be fixed to the element at said point.

9. A mounting structure according to claim 1 or 3, in which the azimuth angle rough-adjustment member includes at least one locking screw (8,9) extending through the sleeve wall or at least one U-bolt (D) which detachably clamps the axle against the holder.

Fig. 1

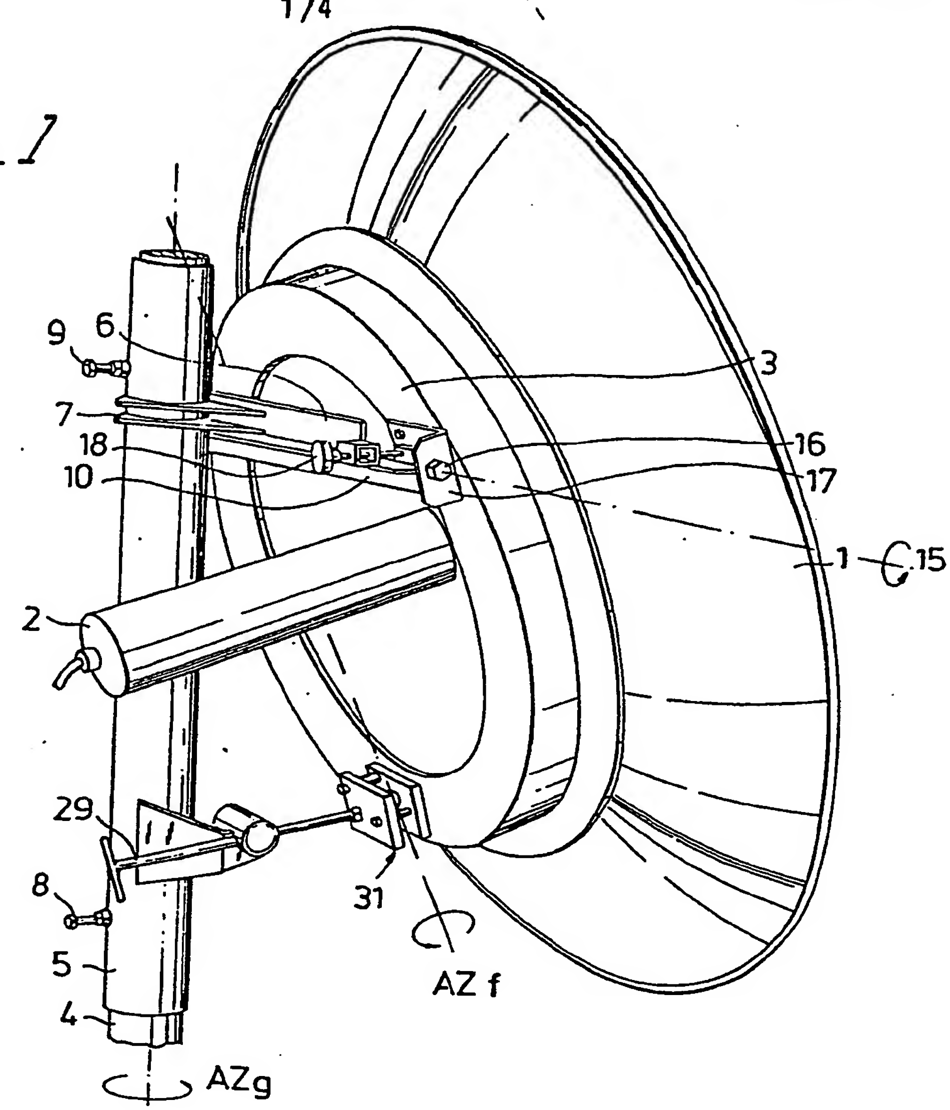


Fig. 2

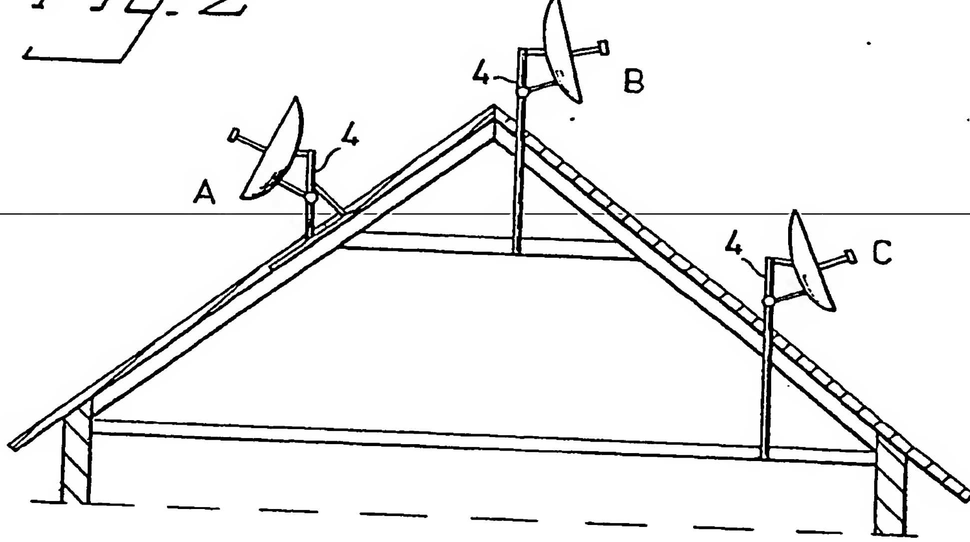


Fig. 3

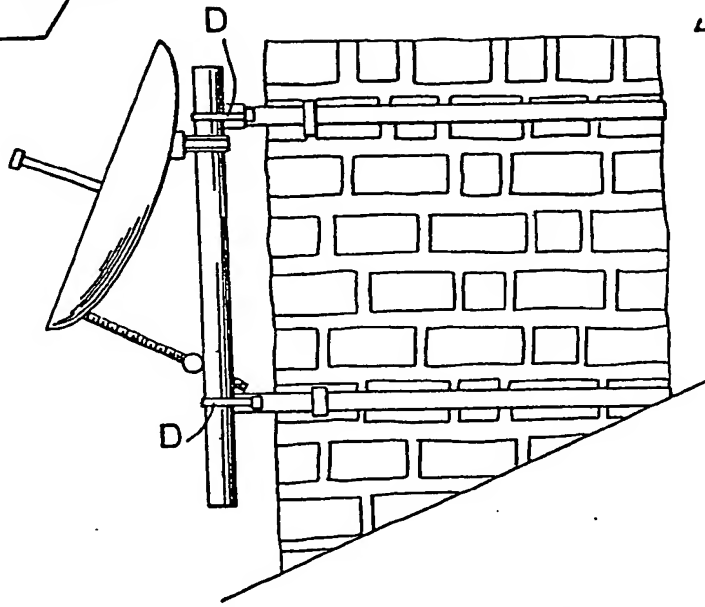


Fig. 4

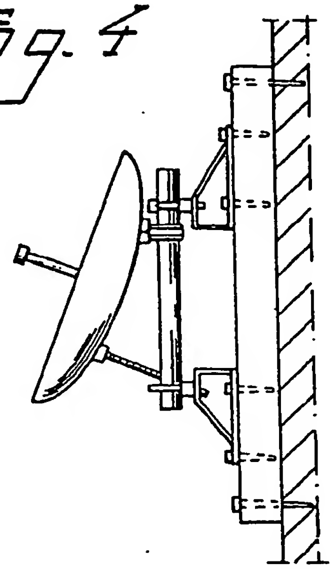


Fig. 5

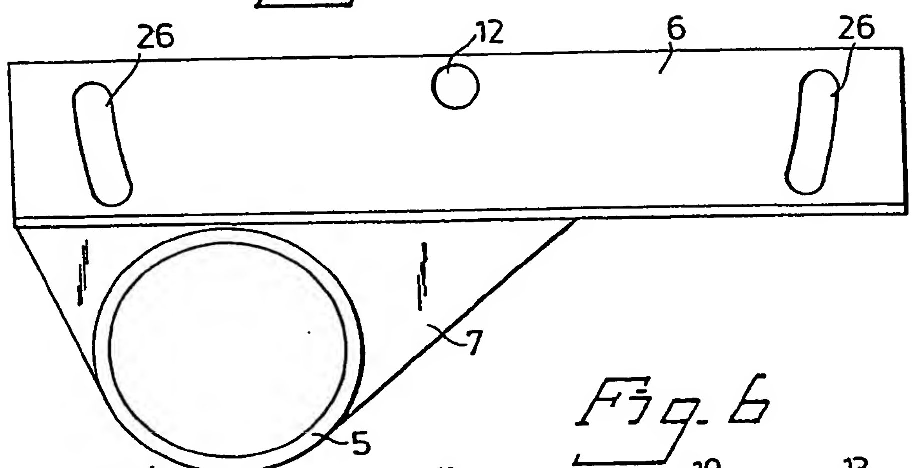


Fig. 6

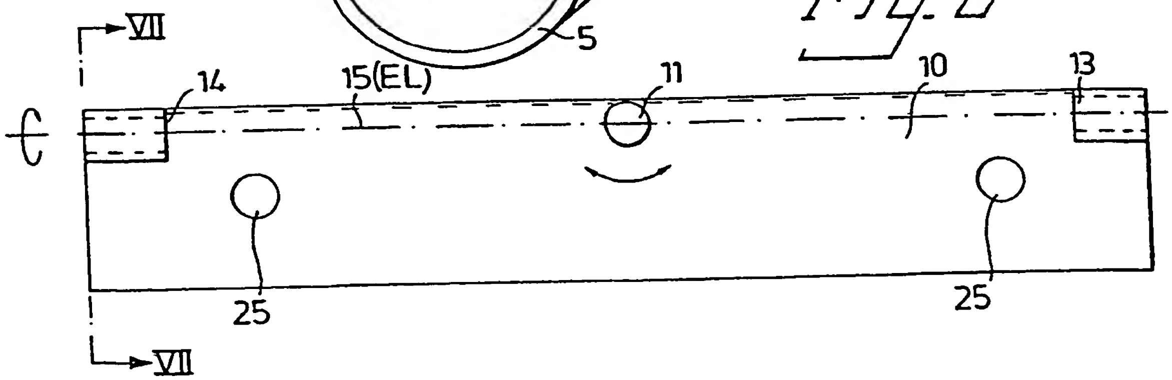


Fig. 7

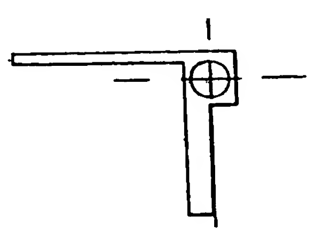


Fig. 8

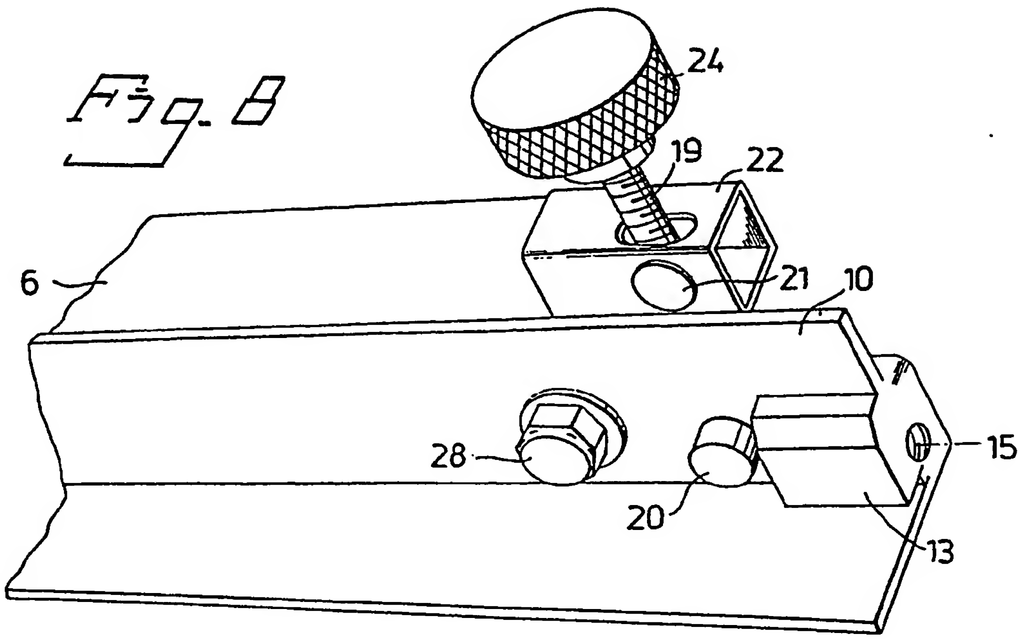


Fig. 9

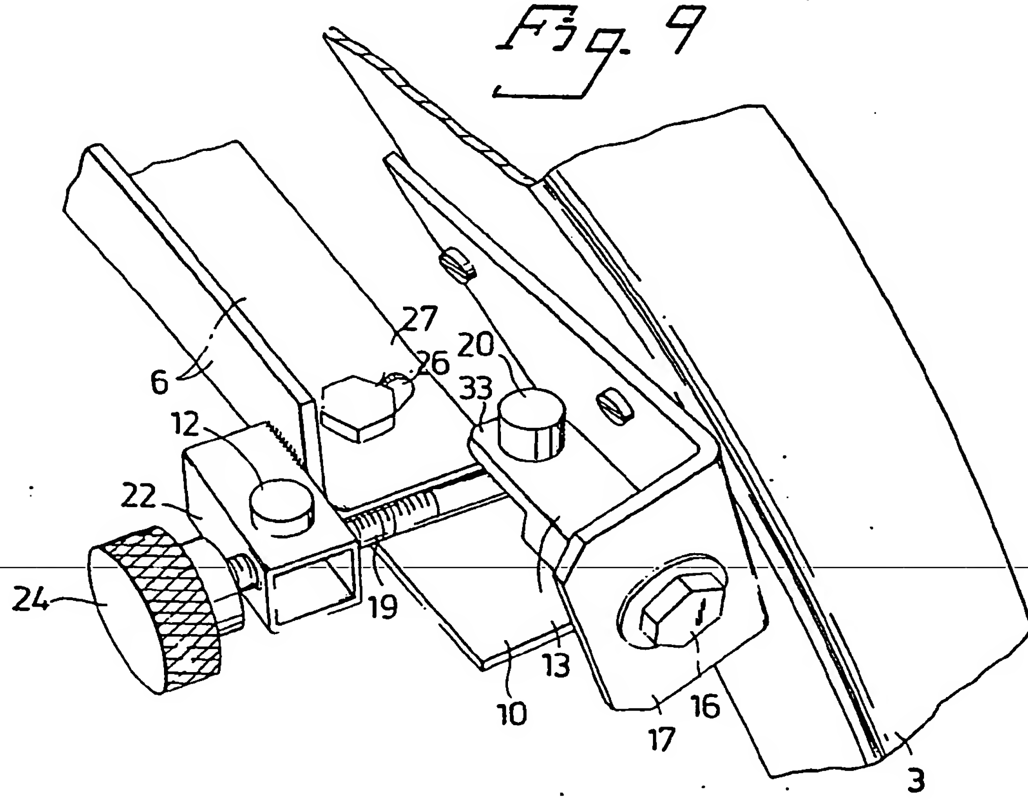


Fig.10

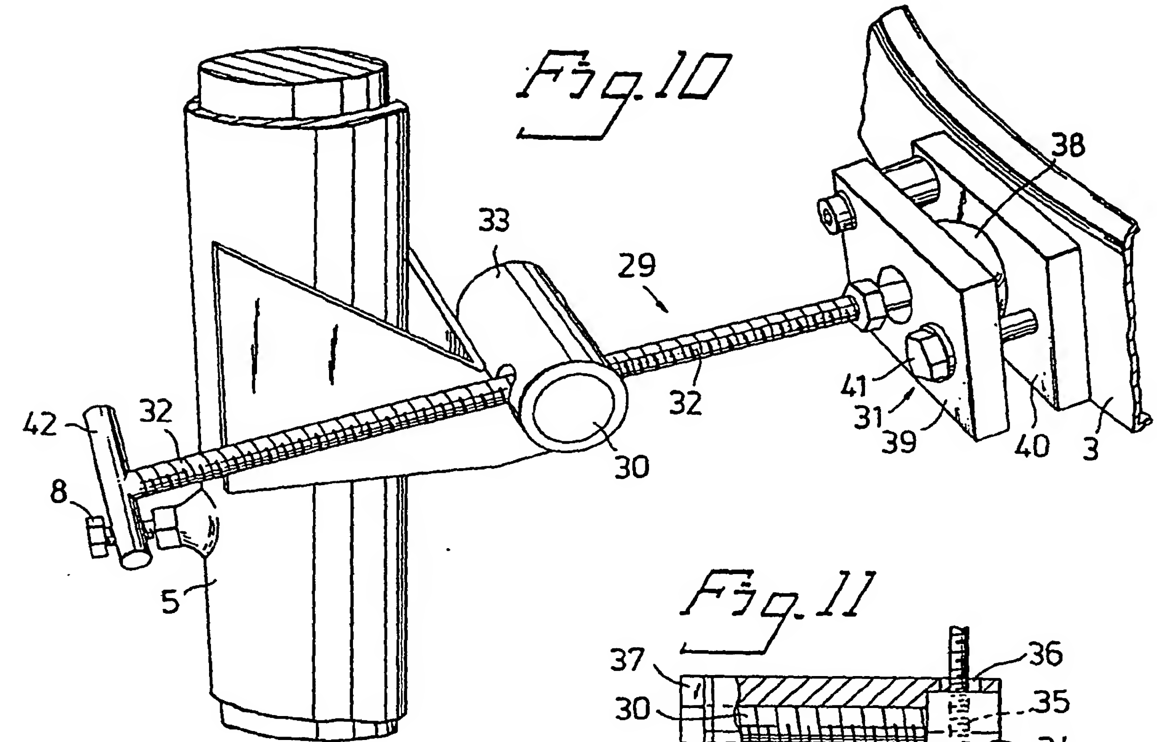


Fig.11

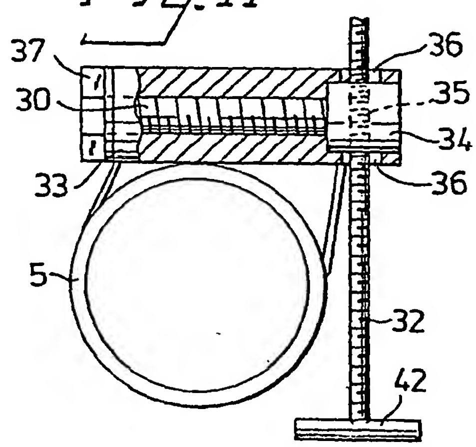


Fig.12

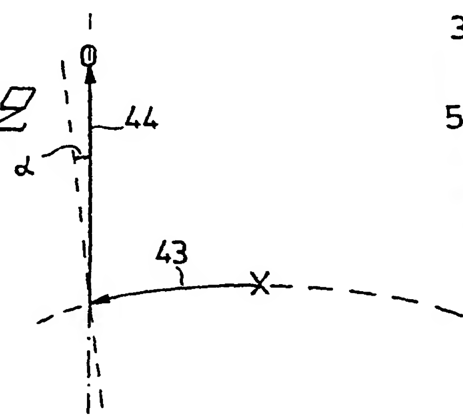
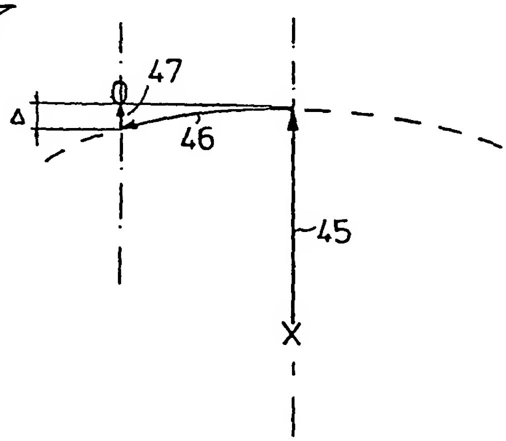


Fig.13



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EUROPEAN SEARCH REPORT

Application number

EP 81 85 0066.2

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	US - A - 4 126 865 (D.W. LONGHURST et al.) * fig. 1 to 5 *	1
	DE - A - 1 956 172 (SIEMENS) * fig. 1 to 2 *	1
	US - A - 2 767 240 (C.A. WEBSTER et al.) * fig. 2, positions 38, 40 *	9
A,P	EP - A1 - 0 026 001 (SIEMENS) * fig. 1 to 4 *	
A,P	US - A - 4 204 214 (C.J. FASSNACHT) * fig. 1 to 4 *	
A,P	Patents Abstracts of Japan Vol. 4, No. 141, 4 October 1980 page 41E28 & JP - A- 53 - 165623	
A	Patents Abstracts of Japan Vol. 3, No. 60, 23 May 1979 page 26E112 & JP - A - 54 - 37661	

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

H 01 Q 1/12
H 01 Q 3/08

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

H 01 Q 1/00
H 01 Q 3/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	25-06-1981	BREUSING

EPO Form 1503.1 06.78